JOURNAL
OF THE
WASHINGTON ACADEMY OF SCIENCES

VOL. 14 FEBRUARY 4, 1924 No. 3

PHOTOGRAPHY.—*Stereoscopic photography in geological field work.* F. E. WRIGHT, Geophysical Laboratory, Carnegie Institution of Washington.

Photography has rendered valuable services to geology both by providing illustrations for geological literature and, to a much greater extent, by furnishing note-book reminders of geological field relations which were difficult to describe concisely. The geologist on his return home from the field is aided by the snapshots he has taken to revisualize the field relations and thus to interpret the recorded data. The photographs are valuable to him in the degree they contribute to the revisualization process. If a print is large and the view is well chosen with regard to a proper foreground, so that the perspective relations are emphasized and even overemphasized, the observer gathers at first glance the impression of space and of the relative positions of the several details in the picture. If, on the other hand, the print is small with but little contrast in light and shade to bring out the perspective, the picture fails to convey to the eye an adequate impression of space. It is "flat," and is unsatisfactory both pictorially and for purposes of study. In some instances these defects can be remedied by making an enlarged print on contrast paper or by examining a small print on contrast paper through a magnifying glass.

Photography to the geologist is simply a means to an end, namely, to record certain spacial relations between details of geological interest in the field. He is not concerned primarily with the making of a photograph of artistic merit. His photograph should tell clearly the story of the field relations between certain geological features and everything must be subordinated to this story, otherwise the point may be lost. This means that the two factors, sharpness of detail and perspective

are essential; if, at the same time, a balanced rendering of the subject is possible, so much the better, but in no case should the correct rendering of geological details be sacrificed to gain pictorial quality. Another factor, that of scale, is also essential. Not only should the relative positions, but also the relative sizes of the details be represented by the photograph. In the case of near objects, such as rock exposures in a quarry or a cliff, a scale of known dimensions, as a geological hammer, or a hat, may be purposely introduced into the picture; for larger objects the figure of a man, looking toward the geological object and not toward the camera, may serve as a suitable scale. For objects at a distance, as a mountain side, a foreground is necessary not only to give the impression of distance, but also to convey an idea of the size of the mountain. A view taken from an elevated position, looking out over a wide plain or a valley is always disappointing because it fails to furnish a scale by which to measure distances and does not convey the impression of limitless expanse, which the observer on the mountain peak felt while taking the photograph.

Sharpness of detail in depth is attained by means of a small lens aperture. Color values are rendered so that they agree fairly well with the visual impressions by the use of color sensitive plates or films and properly adjusted ray filters. Perspective is attained chiefly by means of the foreground which, if skilfully selected, leads the eye from near objects to the more distant objects of geological interest and thus creates the impression of space and perspective. It is a simple matter to test this conclusion by first covering the foreground in a good photograph of distant mountains or hills and then observing the increase in apparent distance and perspective as the foreground is uncovered.

In the field the geologist is more or less encumbered with field apparatus and necessarily adopts the simplest camera that will answer the purpose. This is commonly a roll film camera of postcard size and equipped with a lens of focal length about 7 inches. Photographs taken with a lens of this focal length appear more natural and the depth relations stand out more clearly if they are examined through a reading glass. The effect of the reading glass is not only to magnify the print from one and one-half to twofold, but also to shift the image to a position more nearly in accord with that obtaining in the field where the objects were viewed directly. The combination of these two factors produces the enhanced stereoscopic effect or perspective obtained by use of the reading glass.

In case the geologist is in a position to carry a greater load, a larger camera, 5 by 7, or even larger, with a series of lenses or lens combinations covering a wide range in focal lengths enables him to obtain results not possible with the small hand camera. Even with the postcard size camera a small tripod well repays the extra trouble it may cause. By using a small lens aperture and a suitable ray filter, and by making a short time exposure with the camera mounted on a tripod, the geologist is more certain of uniformly good results than he can be with ordinary snapshots. Experience has shown that in the photography of geological subjects ample exposure (even slight over exposure) of the film and the use of adequate amounts of restrainer (potassium bromide) in the developer produces the best average results.

It is evident from the foregoing that geological photographs are essentially technical in character rather than pictorial; that the criteria for excellence in a geological photograph, are degree of sharpness, perspective, and scale; in other words, degree of exactness of representation of the field relations. If in addition pictorial quality is present in the photograph it may well serve for illustration purposes; pictures which tell a geological story and at the same time have artistic merit are rare. The geologist who introduces into his photographs as much of the pictorial element as the circumstances permit, but with due regard to accuracy in representation, is rewarded by genuine appreciation of his efforts. This would be lacking were the pictorial element lacking.

The feeling of space or stereoscopic effect in a photograph depends on the emphasis given to the perspective, and this is in part attained by means of a proper foreground with strong contrasts; but in the field a foreground of this character may not be available, and the resulting photograph is flat and represents inadequately the spacial relations. At best the stereoscopic effect in a photograph lags greatly behind the picture in the field, and there seems to be no remedy for this unless the geologist is willing to take two photographs of the object from slightly different positions and view the prints through a stereoscope Adequate representation is attainable only by means of stereoscopic photographs which enable the geologist at home to study the field relations in detail with a degree of certainty not attainable in the single view photograph. The taking of the two photographs requires no new apparatus; the two photographs are made with the same camera, one after the other, at points separated by a distance dependent on the distance to the object to be photographed. It is surprising, in view of the ease with

which stereoscopic photographs can be taken with the ordinary hand camera and without a tripod, that this method is not in general use among geologists. This disregard of the stereoscopic method may be due to two factors, namely; the idea that a special stereoscopic camera is required; and the development of stereogrammetric methods for

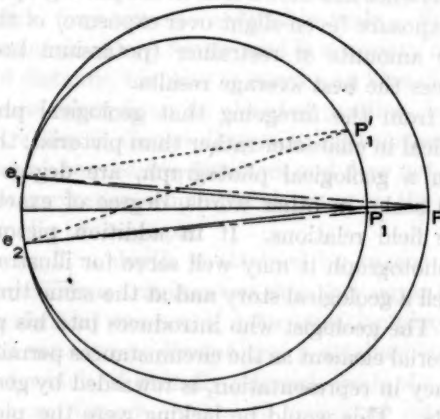


Fig. 1. Diagram to illustrate the principle of stereoscopic resolving power in depth.

field surveying which require special apparatus and are not adapted to ordinary geological field work. The purpose of this note is to emphasize the value of stereoscopic photographs in geological field work and to indicate briefly certain practical details in connection with the taking of stereoscopic views with an ordinary film camera.

*Stereoscopic vision.* Our ability to recognize the relative distances to two points $P_1$ and $P_2$ (Fig. 1) depends on the sensitivity of the eyes to slight angular changes between the lines of sight of the two eyes and to a much less degree on the change in focus of each eye as the line of sight passes from $P_1$ to $P_2$. In Fig. 1 let $e_1$, $e_2$ represent the two eyes; $P_1$ and $P_2$, two object points located at distances $D_1$ and $D_2$ respectively from the eyes. The angle between the lines of sight to $P_1$ is $e_1P_1e_2$, and to $P_2$, $e_1P_2e_2$. The difference between the angles $e_1P_1e_2$ and $e_1P_2e_2$

is the angular shift which takes place between the lines of sight to $P_1$ and $P_2$ respectively. It is evident from Fig. 1 that all points on the circle $e_1e_2P_1$ subtend at the eyes $e_1$, $e_2$ the same angle $e_1P_1e_2$; similarly all points on the circle $e_1e_2P_2$ subtend the angle $e_1P_2e_2$. If the interpupillary distance $e_1e_2$ be standard, namely 65 mm., the distance along the chord $e_1e_2$ is so nearly equal to that along the circumference for circles 1 meter and over in diameter that the difference (0.046 mm. or less) is for practical purposes negligible. On this assumption we derive directly from Fig. 1 for the points $P_1$ and $P_2$

$$\alpha_1 = \frac{e_1e_2}{D_1} = \frac{b}{D_1} \qquad \alpha_2 = \frac{e_1e_2}{D_2} = \frac{b}{D_1 + d}$$

wherein $b = e_1e_2$ and $D_2 = D_1 + d$. The angular difference in radians is accordingly

$$\alpha_1 - \alpha_2 = \frac{b}{D_1} - \frac{b}{D_1 + d} = \frac{b \cdot d}{D_1(D_1 + d)} = \frac{b \cdot d}{D_1^2\left(1 + \frac{d}{D_1}\right)}$$

As a rule $d$ is a very small quantity compared with $D_1$ and the equation may be written as a first approximation

$$\Delta\alpha = \alpha_1 - \alpha_2 = \frac{b \cdot d}{D_1^2} \qquad (1)$$

This equation indicates that for short distances to $P_1$ the change in angle for a given distance $d$ is large; for greater distances to $P_1$ the change in angle is much less for the same interval $d$ as is shown by Table 1 computed on the basis of an interpupillary distance $e_1e_2 = 65$ mm.

TABLE 1.—Angles Subtended at the Eyes (Interpupillary Distance 65 mm.) by the Lines of Sight to an Object Point at a Given Distance in Meters

| Distance to $P_1$ in meters | Angle between lines of sight | Distance to $P_1$ in meters | Angle between lines of sight |
|---|---|---|---|
| 0.25 | 14° 48.83′ | 20 | 0° 11.17′ |
| 0.50 | 7 26.28 | 30 | 0 7.45 |
| 0.75 | 4 57.75 | 40 | 0 5.58 |
| 1.00 | 3 43.38 | 50 | 0 4.47 |
| 2.00 | 1 51.72 | 100 | 0 2.23 |
| 3.00 | 1 14.48 | 200 | 0 1.11 |
| 4.00 | 0 55.86 | 300 | 0 0.74 |
| 5.00 | 0 44.69 | 400 | 0 0.56 |
| 10.00 | 0 22.34 | 500 | 0 0.45 |
| | | 1000 | 0 0.22 |

Experiments by Helmholtz[1] and others on the ability of the eyes to distinguish the relative distances of objects from the observer have proved that on the average two points separated stereoscopically (in depth) by 30″ of arc and in exceptional cases by 10″ or 12″ or even less are recognized as situated in different planes. If therefore we assume a value

$$\Delta\alpha = \alpha_1 - \alpha_2 = 0.0001 \text{ in radians or } \Delta\alpha = 20.63''$$

equation (1) becomes

$$d = \frac{0.0001 \cdot D_1^2}{b}$$

*Stereoscopic views.* In the stereoscopic photography of geological features the combination of camera lens and plate functions as the eye. The distance between the two camera positions corresponds to the interpupillary distance and equation (1) is directly applicable, if the focal length of the camera lens is taken into account. The photographs thus taken are viewed with the aid of a stereoscope which may or may not be equipped with weakly magnifying lenses. The stereoscope is necessary because the eyes, as a result of long practice and habit, perform a series of operations automatically in passing from one object to another; at the same time that the object is brought to focus the lines of sight are adjusted for the distance. In the case of two photographs placed at the distance of near vision the eyes tend, in focussing on the photographs, to converge the lines of sight to a single point of a single photograph, whereas to see stereoscopically it is essential that the right eye focus on the right hand photograph, the left eye on the left. This it is possible to do with practice, but in general it is simpler and involves less eye strain to superimpose the two photographs by means of a stereoscope either of the reflecting mirror type (Wollaston or Helmholtz) or of the lens refracting type (Brewster or Helmholtz) in which the photographs are viewed through weak lenses so placed that the distances to the images appear to be comparable to those of the original object. In the case of a lens stereoscope the image is also enlarged and the stereoscopic effect is thereby enhanced.

[1] H. v. HELMHOLTZ, Physiologische Optik 814 et seq. 1896; O. HECKER, Zeitschr. Instrumentenkunde **2**: 372. 1902; C. PULFRICH, Zeitschr. Instrumentenkunde **21**: 221. 1901; **22**: 65, 133, 178, 229. 1902; **23**: 43. 1903; **25**: 233. 1905; J. W. FRENCH, Trans. Opt. Soc. **24**: 226. 1923.

As a first approximation we may consider that the stereoscopic effect increases directly with the degree of enlargement of the photograph; and this in turn increases with the focal length of the camera lens and with the magnification by the stereoscope. Equation (1) may accordingly be written

$$\alpha_1 - \alpha_2 = \frac{d \cdot b}{D_1^2} \cdot \frac{f}{l} \cdot N \qquad (2)$$

wherein $f$ is the equivalent focal length of the camera lens, $l$ the distance at which the photographs are viewed by the eye (commonly 10 inches or 25.0 cm., the distance of near vision), $N$ the magnifying power of the stereoscope which, as ordinarily defined, is the ratio of the apparent height of the image observed through the lens at a distance $l$ (10 inches) to the height of the object itself. Assuming the value, $\alpha_1 - \alpha_2 = 0.0001$, the magnifying power of the stereoscope to be $N = 2$, the distance of near vision $l = 10$ inches, we may write equation (2)

$$b = \frac{0.0001 \cdot 10}{2} \cdot \frac{D_1^2}{d \cdot f} = 0.0005 \cdot \frac{D_1^2}{d \cdot f} \qquad (3)$$

Thus if a lens of focal length $f = 7$ inches, the separation $b$ of the two camera positions required for a depth resolution of 1 per cent of the distance, $d = 0.01\ D$, is

$$b = \frac{0.0005 \cdot D_1}{0.01 \times 7} = 0.0071\ D_1$$

For $d = 0.001$, $b = 0.071\ D$; for $d = 0.005$, $b = 0.014\ D$. For a lens of focal length $f = 20$ inches we find for $d = 0.01\ D$, $b = 0.0025$; for $d = 0.001\ D$, $b = 0.025\ D$; for $d = 0.005\ D$, $b = 0.005\ D$. Similarly for an object at 2000 feet distance, the separation of camera positions with a lens of 12 inch focus required to enable the observer to recognize a depth difference of 2 feet ($d = 0.001\ D$) in the stereoscope is $b = \frac{0.0005 \cdot 2000^2}{2 \times 12} = 83.7$ feet.

In general it may be stated that, with ordinary cameras having lenses of focal lengths between 5 inches and 20 inches, a camera sepration of $\frac{1}{2}$ to 5 per cent of the distance suffices for critical stereoscopic studies; commonly a camera separation of 1 to 2 per cent of the distance to the object suffices. The greater the camera separation (up to 10 per cent) the higher the resolving power in depth. A separation $b$ exceeding 10 per cent of $D$ is likely to produce exaggerated perspective.

In the taking of stereoscopic views of geological features with a single camera the best results are obtained by holding the camera horizontal, by pointing it directly at the object, and by selecting, in a line approximately at right angles to the lines of sight, two positions from which the two views are taken, such that their distance apart is from $\frac{1}{2}$ to 5 per cent of the distance to the object.

*Experimental tests.* In order to test the validity of equation (2) and incidentally to test the stereoscopic sensitivity of the eyes, a framework was constructed which consists essentially of a thick cardboard top

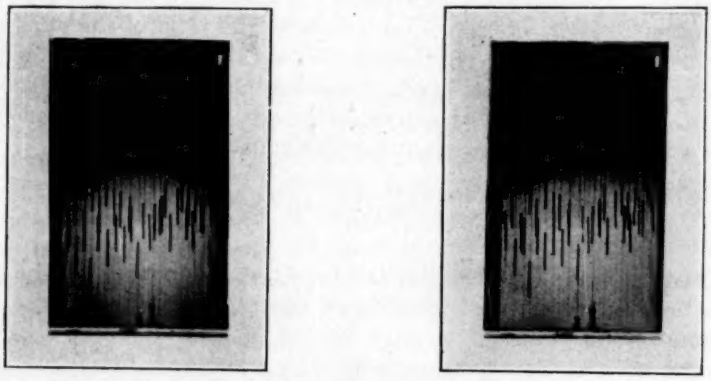

Fig. 2. Stereoscopic photographs of test objects taken at a distance of 20 meters with a camera lens of 22.7 inches focal length; the distance between the two camera stations was 40 cm.

and bottom each about 1 meter square, into which holes were drilled at different distances from the front edge. Through these holes cords were passed and through loops in the cords pencils were attached so that when mounted (Fig. 2) and viewed from a distance a number of vertical pencils appeared to be suspended in mid air against an illuminated back ground of white cloth tacked to the rear side of the framework. This group of suspended pencils was then photographed at a distance of 20 meters, with the camera at different distances of separation and with different lenses of focal lengths ranging from 7 inches to 69 inches. The minimum depth separation of the pencils was 4 cm. or 0.002 of the total distance. Prints of the photographs were then studied with the aid of a stereoscope equipped either with achromatic lenses of different focal lengths (E.F. = 80, 151, 190, and 241 mm.)

or with reflecting mirrors (Helmholtz arrangement). The separation of two adjacent lead pencils ranges from 4 cm. to 1 meter. As the observer passes from one part of the diagram to the other he records the relative positions in depth of the several pencils. The results which are listed in Table 2 are not very concordant. The degree of accuracy

TABLE 2.—THE DEPTH SEPARATION IN CENTIMETERS EASILY DETECTED STEREOSCOPICALLY, WITH THE AID OF A STEREOSCOPE OF MAGNIFYING POWERS RANGING FROM 1 TO 3.81, ON PHOTOGRAPHS TAKEN OF THE TEST OBJECTS (FIG. 2) AT 20 METERS DISTANCE AND WITH DIFFERENT CAMERA LENSES AND DISTANCES BETWEEN THE CAMERA POSITIONS

| E.F. OF CAMERA LENS | DISTANCE BETWEEN CAMERA POSITIONS | MAGNIFICATION BY STEREOSCOPE | | | |
|---|---|---|---|---|---|
| | | 1 | 1.93 | 2.49 | 3.81 |
| | | Stereoscopic depth in cm. resolved on photographic prints | | | |
| cm. | cm. | | | | |
| 12.0 | 10 | 64 | 32 | 28 | 28 |
| | 20 | 48 | 24 | 20 | 16 |
| | 30 | | 16 | 16 | 12 |
| | 40 | 24 | 12 | 12 | 12 |
| | 80 | 16 | 8 | 8 | 8 |
| 22.7 | 20 | 20 | 16 | 12 | 12 |
| | 40 | 16 | 12 | 8 | 8 |
| | 60 | 12 | 8 | 4 | 4 |
| | 80 | 8 | 4 | 4 | 4 |
| 68.7 | 10 | 20 | 16 | 16 | 12 |
| | 20 | 16 | 12 | 12 | 8 |
| | 30 | 8 | 8 | 8 | 4 |
| | 40 | 8 | 4 | 4 | 4 |

obtainable was found to be in part dependent on the quality of the photographic prints. The data were converted by means of equation (2) into angular values and these were then plotted on coordinate paper; the general trend of the values suffices to indicate that for the stereoscopic effect depicted in the photographs, the magnification factors introduced into the formula covering focal lengths of the camera lenses and magnifying power of the stereoscope are too large; in other words the stereoscopic effect under these conditions is increased with the magnification of the image but the degree of increase is appreciably less than that indicated by the formula. For the purposes for which the photographs are to be used, equation (2) may be considered, however, to represent the situation with sufficient accuracy. More detailed work would be required to determine the exact form of the equation with a given type of photographic print.

*Summary.* In geological field work stereoscopic photographs taken by the ordinary roll film camera are of value in assisting the geologist to

revisualize the relations studied in the field. Details which may have escaped his notice are brought out much more effectively than in the single photograph. The taking of stereoscopic photographs for this purpose does not require special apparatus. To obtain good stereoscopic effects it is advisable to take two photographs, one after another and from different positions, of the geological features to be recorded, the distance between the two camera stations to be from 1 to 5 per cent of the distance of the object itself, the camera in each position to be pointed at the object and the lines joining the camera stations to be approximately normal to the lines of sight to the object. The stereoscopic effect can be enhanced if enlarged prints of the negatives are made and a lens stereoscope of the ordinary type is used in the examination of the prints.

BOTANY.—*Two new species of* Jamesonia.[1] WILLIAM R. MAXON, National Museum.

Recent large collections of ferns from the Andes of South America have contained numerous specimens of *Jamesonia*, necessitating a revision of the genus. Of several species regarded as undoubtedly new two are described herewith.

**Jamesonia brunnea** Maxon, sp. nov.

Rhizome flexuose, wide-creeping, brown, terete, lignose, 3 to 4.5 mm. in diameter, densely clothed with oblique bright brown setae (2.5 to 3.5 mm. long). Fronds few, long-stalked, 55 to 70 cm. long, distichous, 7 or 8 mm. apart, erect-arcuate; stipes 25 to 30 cm. long, stout (1.5 to 2 mm. in diameter), subflexuose, brown, subangulate above, deciduously appressed-setose; blades linear, 25 to 30 cm. long, slightly attenuate toward the base, the rachis stout, brown, strongly compressed, lightly bisulcate above, everywhere densely and coarsely crispate-hirsute with broad flattish brown-ferruginous septate hairs, these never forming a tomentum; pinnae numerous, borne in two close rows on the upper side of the rachis, alternate, horizontal, usually arranged closely in a *single* scalariform series, stalked (1.5 to 2 mm.), broadly orbicular-ovate, rounded in the apical portion, truncate or very broadly cuneate at base, rigidly spongiose-coriaceous, strongly convex, broadly and deeply revolute, the slightly thinner margin freely ciliate (the cilia close, weak, flexuose, pale ferruginous, 1 mm. long); upper surface of pinnae strongly glandular-viscid, vernicose; lower surface glandular-pubescent and freely crispate-hirsute, chiefly along the veins, the shorter hairs erect and capitate, the long ones flexuose and septate like those of the rachis; larger pinnae 6 to 7 mm. long, 5 to 6 mm. broad; venation pinnate-flabellate, deeply immersed, barely evident above, coarsely corrugate beneath, 20 to 24 branches attaining the margin; sporangia not observed.

[1] Published by permission of the Secretary of the Smithsonian Institution.

Type in the U. S. National Herbarium, no. 1,067,752, collected at the summit of Mount Guamaní, Ecuador, altitude 4,000 meters, by Father L. Mille (no. 42).

In its large long-stipitate fronds and in its generally coarse aspect and habit of growth *Jamesonia brunnea* recalls *J. verticalis;* but the resemblance goes no farther, *J. verticalis* having, for example, adnate pinnae, in which it is unique. *J. brunnea* is more nearly related to *J. tolimensis* (Hieron.) C. Chr., of Colombia, which agrees in having the fronds long-stipitate and the pinnae truncate, ciliate, viscid-glandular above, and with a mixed glandular and septate-hairy covering beneath. *J. tolimensis* is, however, a smaller plant and has the pinnae chartaceous, sessile, roundish-obovate to obovate-elliptical, and the margins lobulate-crenate to crenulate, and short-ciliate (the cilia 0.5 mm. long or less), in all of which characters it differs from *J. brunnea.*

There is no other described species with which *J. brunnea* need be compared. The ladder-like arrangement of the alternate pinnae in a single or nearly single series at the upper side of the arcuate rachis is not due to pressure in drying, being quite as conspicuous in leaves that are restored to normal condition by boiling.

**Jamesonia ceracea** Maxon, sp. nov.

Rhizome wanting. Fronds (mature) 10 to 20 cm. long, nearly straight above the curved base; stipe 1 to 3 cm. long, 0.3 to 0.5 mm. in diameter, flexuose, strongly curved at summit, dark chestnut-brown, lustrous, minutely striate, deciduously and laxly setose, the hairs few, flattish, pale ferruginous, septate; blades 9 to 17 cm. long, 2 to 3.5 mm. broad, narrowly linear, long-attenuate toward the apex, the tip also attenuate though indeterminate; rachis relatively stout, castaneous, wholly concealed beneath by a dense imbricate covering of spreading or recurved, buff or pale ferruginous, flat, septate hairs, these concealing only the bases of the pinnae, persistent; pinnae 75 to 115 pairs, short-petiolate (about 0.5 mm.), alternate, mostly imbricate and horizontally deflexed in two contiguous rows upon the upper side of the rachis, those of the lower part spreading, more than their width apart, the lowermost ones distant; largest (middle) pinnae about 2.5 mm. long, 1.8 mm. broad, obliquely and broadly oblong from a subcordate inequilateral base, rigidly herbaceo-coriaceous, strongly convex, the deeply recurved margin nearly 0.5 mm. broad, crenately constricted, bordered abruptly by a broad whitish membranous true indusium, the aperture between the indusia 0.5 mm. broad or less; upper surface of pinnae grayish green, nearly glabrous, bearing a few minute short appressed whitish glandlike hairs; lower surface densely and deeply covered by minute white ceriferous hairs, the loose ceraceous mass mostly concealed by the revolute margins and broad indusia, persistent; venation pinnate-flabellate, deeply impressed, the branches 5 or 6 in number; sporangia not detected.

Type in the U. S. National Herbarium, no. 1,042,371, collected on steep páramo slope of Mount Chuscal, west of Zipaquira, Department of Cundi-

namarca, Colombia, altitude 3,100 to 3,200 meters, October 22, 1917, by Francis W. Pennell (no. 2607).

In size and general appearance *Jamesonia ceracea* is not very unlike small forms of *J. imbricata* (Cav.) Hook. & Grev., which it resembles also in having a relatively broad true indusium. It differs widely from that species in nearly all minute characters, however, and is the only member of the genus with ceraceous pinnae. The waxy indument of the under surfaces is not due to a juvenile condition or to extreme age, but is a definite morphological character. The loose waxy mass, which is persistent and is evident at all ages, is not quite amorphous, the presence of short, white, intermingled secreting hairs being readily demonstrable.

## PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

### THE BOTANICAL SOCIETY

#### 167TH MEETING

The 167th meeting of the Botanical Society was held at the Cosmos Club April 3, 1923 with President L. C. Corbett in the chair and 32 persons present. N. REX HUNT was elected to membership in the society.

Program: F. V. COVILLE: *Experiments in Rhododendron culture.* (Illustrated). It has been recognized for some time that when rhododendrons have been taken from their natural habitat and planted around houses they frequently stagnate and die. This condition is caused by the change from an acid to an alkaline soil. Nurserymen claimed that rhododendrons could thrive in an ordinary fertile soil through the application of magnesium sulfate. It was decided to try magnesium sulfate and aluminum sulfate, also, in an experiment to bring about an acid reaction in an alkaline soil. A solution of magnesium sulfate stimulated the growth of seedlings of *Rhododendron catawbiense* to a slight degree, while a solution of aluminum sulfate very greatly stimulated the growth of the plants. A full discussion of *The effects of aluminum sulfate on Rhododendron seedlings* is presented in a paper by Dr. Coville, published as Bulletin 1 of the American Horticulture Society.

RUDOLF KURAZ, Secretary of the Czechoslovak Legation: *Seed control in Czechoslovakia.* The growing of cereals and industrial plants for seed is a well established industry in Czechoslovakia. For the protection of the growers as well as the purchasers a seed control law was passed by the National Assembly on March 17, 1921, supplementary regulations going into effect June 15, 1921. The law provides for official inspection, analysis, certification, and registration of original varieties developed by the growers and of seeds grown for them. Only those growers who have complied with the requirements of the law may use the designations "original variety," "certified seed," "certified seedlings," and "registered variety." The Ministry of Agriculture, charged with enforcement of the law, appoints certifying commissions for the various districts, as well as the Central Certifying Commission, an advisory body with offices at Prague. The analysis of seeds and the control of the trade in seeds have been intrusted to four

testing stations, or research institutes. A certifying commission has at least eight members and eight alternates, selected from among the expert officials of agricultural associations, instructors in agricultural colleges and other schools, and professional seed growers. Membership on the commission is purely honorary; the members receive no salaries and are compensated only for their actual expenses.

A. S. HITCHCOCK: *The proposed tropical biological station in the Panama Canal Zone.*

The Institute for Research in Tropical America, consisting of 5 museums, 6 universities, and 10 scientific societies, was organized in 1922 for the purpose of promoting research in tropical America. The Executive Committee decided to give prominence to research in Panama, because of the unusual biological conditions found here. The Isthmus is a bridge across which nearly all the migrations of land animals have taken place, and two great oceans are closer together here than in any other tropical region. Moreover, the physical conditions on the two sides of the Isthmus are distinctly different, and there is a corresponding difference in the marine faunas. The Atlantic side is uniformly hot; the Pacific side is cooler because of the cold currents from the north and south. Into these conditions has been thrown a disturbing factor—the Panama Canal. What effect will this have on the biological conditions?

The Institute will proceed with its program as soon as financial support is obtained. It is hoped to utilize the laboratories of the institutions already established in Panama, and to coöperate with all agencies interested in developing the resources of that region.

R. KENT BEATTIE, *Recording Secretary Pro Tem.*

### 168TH MEETING

The 168th meeting was held at the Cosmos Club May 1, 1923, with President L. C. Corbett in the chair and 65 persons present. H. C. DIEHL, F. P. SCHLATTER, JAMES H. BEATTIE, and F. L. GOLL were elected members of the society.

Brief notes: F. P. METCALF outlined his prospective work in China as head of the Botany Department at the Fukien Christian University. This school has financial support from the Chinese Government.

C. R. BALL spoke of the presence in the city of the representatives of foreign mission fields as guests of the Department of Agriculture.

Program: W. J. MORSE: *The soybean, abroad and at home.* (Illustrated.) The rapid rise of the soybean, also called soya and soja bean, to a crop of special importance in the world's commerce in the past few years is one of the important commercial events of recent times. It is a plant of ancient cultivation in China, Japan, and Chosen (Korea). The annals of Old China state that the soybean was an important food with the Chinese fully 5,000 years ago. When the ports of China were first opened to foreign commerce, the trade in beans and bean-products was found a long established and flourishing institution. In extent of uses and value the soybean is, at the present time, the most important legume grown in Asiatic countries. In addition to its use as food in the Orient, large quantities are utilized by first extracting the oil and then using the cake for stock feed and as a fertilizer.

At the close of the eighteenth century the soybean found its way to Europe, its cultivation being recorded in England in 1790. It is mentioned in the

United States as early as 1804. For several decades, however, it was regarded more as a botanical curiosity than as a plant of much economic importance. In 1875 Professor Haberlandt began an extensive series of experiments in Austria with the soybean, strongly urging its use as a food, both for man and beast. Although considerable interest was aroused during the experiments, the soybean failed to attain the success hoped by the author of the experiments.

Previous to the Russian-Japanese war, China and Japan were not only the greatest producers but also the greatest consumers of the soybean and its products. During the war the production of the crop was greatly increased throughout Manchuria. After the war, however, it became necessary to find new markets for the surplus beans and trial shipments were made to Europe. The first attempts to introduce the soybean and its products into European markets were generally unsuccessful owing to the inferior quality of the beans and cake, caused by poor shipping conditions. About 1908 a large trial shipment made to English oil mills was received in much better condition than the previous shipments, and the results obtained were so satisfactory that larger imports were made.

The success in the utilization of the soybean as an oil seed extended rapidly to the continental countries, and the importation of beans from Manchuria and Japan soon reached enormous proportions. The beans were utilized by extracting the oil that was found valuable for various industrial purposes, leaving the cake as a cattle food. As the value of the oil and cake came to be recognized, new uses and markets were found, and the trade assumed such large proportions that the soybean has become an important competitor of other oil seeds.

As previously stated, the soybean was introduced as early as 1804, but it is only within recent years that it has become a crop of much importance in the United States. The soybean, until the present season, has been grown primarily as a forage crop. The increased demand for seed, for food, and for planting has led to the development of a very profitable industry in many sections of the cotton and corn belts. The large yield of seed, the ease of growing and handling the crop, the value of the beans for both human and animal food, and the value of the oil and meal, all tend to give this crop a high potential importance and assure its greater agricultural development in America.

C. A. REED: *Glimpses of economic trees and plants of China.* (Illustrated.) So great is the need due to the density of its population and so limited the means of distribution of its products that it would not be far wrong to put all plants of North China into one group, namely, an economic group. In such provinces as Shantung, where the population is in the neighborhood of 600 to the square mile, practically everything is economized with the exception of labor. Every part of the cultivated plants is utilized in one or more ways. China is commonly regarded as being a treeless country, yet the city streets and their various compounds are adorned with such species as whaishu, (*Sophora japonica*), German acacias, willows, catalpas, poplars, ginkgos, jujubes, persimmons, pines of various species, cedars, arbor vitae, pistache, and even oaks, and other genera more or less familiar in this country. Not infrequently, large areas of house tops are hidden from view by foliage in the cities and towns. All brush of the mountains is used either in the manufacture of wicker-ware or for fuel, or other purposes. The sour fruits of the low-growing jujube are gathered for food, and the spiny

branches used for obstructions either as simple fences or barricades on the tops of walls. For fuel, all lower branches of non-fruit producing trees are cut, and the trunks of trees having scaly bark are pared as closely as possible without serious injury. Field crops, such as corn, sorghum, soybeans, millet, etc., are either pulled up by the roots at harvest time or cut in the usual way, and later the roots are taken up and used for fuel. Apparently the soybean nodules on the roots are mainly responsible for the fertility of the soil.

Planted trees along railroad lines, about family cemeteries, or elsewhere in the landscape form some of the most familiar sights throughout the plains sections of Northeast China. Perhaps the most graceful in appearance are the various species of willow. The basket willow, with its side branches removed well up to near the tops of the trees, bears striking resemblance to the American elm. Probably the most highly prized species of tree is that of the white-barked pine, *Pinus bungeana*, which, when dormant, greatly resembles the American sycamore and the Oriental plane. This species is claimed to be exceedingly difficult to propagate and of slow growth, yet exceedingly longlived. For these reasons it was a great favorite with the royalty of at least one dynasty, the Ming. Wherever members of that family established themselves, avenues of these trees were sure to be planted. Single specimen trees and occasional avenues still remain, and in one case a forest of several acres extent is still to be seen, although from 300 to 500 years have elapsed since they were planted, and in spite of the fact that the succeeding dynasty, the Manchu, apparently sought literally to uproot the trees as well as, figuratively, to uproot everything else pertaining to the Ming.

Among fruit-producing trees North China has a great range of species and varieties. Of these, in probable order of excellence, there are the persimmon, pear, jujube, or chinese date, as it is called, and the hawthorne. Of chestnuts there is an equally choice range of strains. The same might be true of walnuts if the product were to be allowed to properly ripen before being harvested. The native apples are of low order; they could doubtless be improved upon by crossing with the wild types of lower New England; certainly this would make the quality no worse. Some of the peaches are very fine and can well. The Bartlett pear was introduced from America some 50 years ago by John L. Nevius, a Presbyterian missionary at Chefoo, who is also credited with having introduced many other American fruits. There is said to be a highly developed fruit industry on the north side of Shantung Peninsula in the neighborhood of Chefoo. Bartlett pears from that section were common on the hotel tables from Peking south to Shantung throughout what seemed to be a long season. The Concord grape appeared somewhat sparingly in an important fruit center, 100 miles to the northeast of Tientsin. However, European grapes lead American varieties in extent of planting, and in some sections they are of large importance. Other American products successfully established in China are the peanut, the sweet potato, and Indian corn. Most American vegetables and fruits have their counterparts in China. The total number of Chinese varieties surpasses that of this country, yet with the exception of paitsi, egg plant, carrots, and a few others, these varieties show little evidence of having been bred up and improved systematically. Walnuts and chestnuts are propagated by seedage only.

ROY G. PIERCE, *Recording Secretary.*

## SCIENTIFIC NOTES AND NEWS

PHILIP S. SMITH, of the Geological Survey, has returned to the Alaska Branch, and will undertake for that Branch and the Navy Department the examination of Naval Petroleum Reserve No. 4, Alaska. JULIAN D. SEARS has been designated Administrative Geologist to fill the position relinquished by Mr. Smith.

The 348th meeting of the Washington Section of the American Chemical Society, on December 13, 1923, was made a special meeting in honor of the seventieth birthday (on December 12) of Dr. W. F. HILLEBRAND, chief chemist of the Bureau of Standards. His long service in the development of analytical chemistry, especially of the silicates, was discussed by several speakers. Dr. Hillebrand presented a paper on *The importance of exact rock analysis for petrology.*

HENRY M. AMI has returned from France to Ottawa and resumed his work in paleontology and chronological geology. During the last six months, serving with the Canadian Government mission on Natural Resources to France, Dr. Ami has carried on researches in pre-history in the Dardagne and elsewhere.

H. A. C. JENISON has resigned from the Geological Survey to accept a position as mining engineer with the Senate Commission on Gold and Silver Inquiry.

A Washington-Baltimore section of the American Ceramic Society was organized December 14, 1923, at a meeting held at the Garden Tea House, Washington. Officers elected were: *Chairman*, B. T. SWEELY; *Vice-chairman*, R. R. DANIELSON; *Secretary-Treasurer*, HERBERT INSLEY; *Councillor*, KARL TURK. A paper on *Use of the petrographic microscope in the ceramic industry* was presented by Mr. Insley. Meetings of the section will be held alternately at Washington and Baltimore.

The Physics Club of the Bureau of Standards has had on its program a series of meetings dealing with *The phenomena and theories of sound.* The following two lectures of this series remain to be delivered: Feb. 4: III, E. A. ECKHARDT: *The characteristics essential to the faithful reproduction of physical phenomena (e. g. oscillographs, phonographs, loud speakers, etc.)* Feb. 11: IV, H. C. HAYES: *Safeguarding navigation by sound.*

The next series of meetings will be devoted to the electrical properties of materials. The following subjects are announced: Feb. 18: I, H. L. CURTIS: *The conduction through dielectrics.* Feb. 25: II, H. L. CURTIS: *Electric absorption and dielectric loss,* Mar. 3: III, F. B. SILSBEE: *Electric strength of insulating materials.* Mar. 10: IV, Subject not yet determined. Mar. 17: V, W. BLUM and H. S. RAWDON: *The mechanism of electro-deposition.*

These meetings extend from 4:30 to 5:30 each Monday afternoon and are open to all interested. The place of meeting is the Lecture Room, Chemistry Building, Bureau of Standards.